building of an informal character. Fig. 1 shows a portion of the new Swindon hospital with one- and two-story buildings for the departments of pathology and physical medicine. Fig. 2 shows a small garden planned in a courtyard within the single-story out-patient department at the same hospital. Fig. 3, also taken from the new Swindon hospital, shows the low buildings for the out-patient and casualty departments, with the future, higher, ward building sketched in the background. Fig. 4 shows the ward block at the Nuffield experimental hospital building at Belfast. Here the treatment of the façade reflects the interior organization of the ward into small nursing units, two on each floor.

These examples suggest that the hospital of the future may perhaps draw architectural inspiration from the size and shape of the functional units within it, whether they be nursing units, out-patient clinics, or other units of care. By expressing these working units in the architecture we can break up the very large masses of building which go to make a modern hospital, and create a more human scale, and an environment more comprehensible and reassuring for the patient.

HOSPITAL CENTRAL STERILE SUPPLY DEPARTMENTS*

BY

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The purpose of a central sterile supply department (C.S.S.D.) is to supply all departments of a hospital—theatres, wards, out-patient and casualty departments—with complete, sterile (and the accent is on "sterile") equipment ready and available for immediate use in the treatment of patients. The only exception to this may be the theatre instruments, which are generally kept, cleaned, sterilized, and used in the theatre suites.

The essentials of the department are correct design, modern plant, skilful operators, and a proper work-flow. Regular skilled maintenance to avoid breakdowns of plant, especially steam-pressure sterilizers, is also essential. The basic equipment consists of steam-pressure sterilizers and hot-air ovens, which provide a uniform standard of sterility of supplies throughout the hospital—a much higher standard than prevails where decentralized boiling-water sterilizers, used for instruments, bowls, syringes, etc., are scattered in wards, theatres, and out-patient and casualty departments, and are manipulated by many persons engaged in multifarious duties. Other advantages include decreased maintenance and replacement costs of expensive equipment, more time for the nursing staff to devote to nursing care, better care and maintenance of instruments and utensils resulting in longer life, and fewer losses of items due to control from the centre at all stages. But perhaps the greatest value of a C.S.S.D. is the supply of sterile equipment designed to suit every procedure in ward or theatre, and the sterility of which can be guaranteed—a further step towards the prevention of hospital infection.

All new and projected hospitals in the United Kingdom include the provision of a C.S.S.D., and many existing hospitals are actively engaged in planning or constructing such a department. The C.S.S.D. in Nuffield House, Musgrave Park Hospital, Belfast, is unique in that it was the first department of its kind to be established within the framework of the National Health Service of the United Kingdom, although the system has been used by British military hospitals during and since the second world war. Nuffield House, an 80-bed surgical unit, was built by the Northern Ireland Hospitals Authority, to the design of the Division of Architectural Studies of the Nuffield Foundation, as a research project on the function and design of hospitals; this building incorporates a C.S.S.D.—a special project designed as a joint investigation, by the Northern Island Hospitals Authority and the Foundation alike, into the value and economics of such a department.

As part of their original investigation the Division had reviewed current practice in centralized departments of this kind in countries abroad, and it was convinced of the need, in the interests of hygiene, safety, and efficiency, to centralize those less personal services such as sterilization, linen, etc.

The Division considered that there was valuable experience to be gained in experimentally grafting a centralized service of this sort on to an existing hospital organization. It therefore welcomed the Northern Ireland Hospitals Authority's invitation to do so at Musgrave Park Hospital. The planning of the department is based on preliminary study, from North American experience, of the flow pattern and general space allocation thought to be desirable.

Whereas syringe supply had previously been the subject of an investigation in this country (Nuffield Provincial Hospitals Trust, 1958) the lack, in a British civilian hospital, of a central service of sterile equipment prevented the Division from carrying out functional studies as a prelude to design. The likely load, the equipment provision and placing, storage, working methods, and production flow had therefore to be envisaged in the absence of precise information from time-and-method studies or previous records. Information collected *ad hoc* on the daily numbers of procedures carried out throughout the hospital and in an acute surgical ward in the teaching hospital formed a basis of calculation in deciding the size of certain equipment. The department is a prototype capable of certain modification as work in it progresses.

The planning of the C.S.S.D. has been steered by a technical subcommittee, which includes representatives of the Northern Ireland Hospitals Authority, the hospital itself, and the Nuffield Division of Architectural Studies, drawing upon the knowledge and experience of the bacteriological, medical, nursing, and administrative staffs. The subcommittee now includes the sister-in-charge of the C.S.S.D., and has met monthly during the last five years to consider problems and to discuss new procedures or alterations to existing procedures in the light of experience, and has given a most valuable contribution to the organization and smooth running of the department.

Nuffield House is attached to Musgrave Park Hospital, which is a general hospital with 701 beds, 302 of which are medical and 399 surgical (239 orthopaedic, 80

*Opening address at a symposium on "Sterilization and Central Supply," organized by the Wessex Regional Hospital Board in Portsmouth for senior administrative medical officers.

general and surgical, and 80 gynaecological). The hospital, consisting mainly of wartime prefabricated buildings, is earmarked for reconstruction, of which Nuffield House is the first stage. In the planning of the work of the C.S.S.D. it must at this point be made clear that Musgrave Park Hospital has no out-patient clinics or casualty department, which may have considerable and unforeseeable demands for sterile supplies.

Layout

The C.S.S.D. (Fig. 1) has a floor area of 2,210 sq. ft. (205 sq. m.) and has four main rooms.

1. Receiving and Clean-up Room

This is the entry to the C.S.S.D. and has a Dutch door. All used goods, except fabrics, are collected from the wards by C.S.S.D. staff in stainless-steel trolleys, kept for this purpose; trolleys are disinfected with "savlon" (hospital concentrate, 1-200). Returned equipment has been rinsed in the wards or theatres after use. Material from the theatres on the floor immediately above the C.S.S.D. is returned in a "dirty" lift, which opens into this room; beside the lift is a hatchway which opens to the outside for transport of used or soiled linen from the theatres to the laundry.

The room is fitted with a stainless-steel bench and double sinks used for disassembling, cleaning, and processing. Syringes are disassembled, washed, and passed through a "soni-cleaner," a tank containing a liquid subjected to ultrasonic vibrations. The capacity of the tank is 80 2-ml. syringes, and the time taken to clean them is 10 minutes. Needles inserted in foam-rubber sponges are also cleaned in this tank, 200 at a time, after being soaked in disinfectant; the time allowed for cleaning is 10 minutes, and they are then tested for blockages. Needles and syringes are finally rinsed in plain and distilled water, the plungers in "pirn" boards and the pistons on trays, before being transferred to the drying cupboard (100° C.) Returned instruments and hardware are disinfected and washed in this room.

This room also had a built-in drying cupboard, the design and working of which proved unsatisfactory, so a free-standing electric drying cupboard has now been installed. This is used for drying syringes, needles, rubber, aluminium-foil containers, Winchesters, and all glass and metal ware, preparatory to assembly of packs.

2. Work Room

This room is fitted with benches, with drawers and kneehole spaces underneath and wall-attached cupboards above. The drawers and cupboards contain all the items required for assembling packs, which is done on the benches and also on stainless-steel trolleys. In this room packs for theatres and wards are assembled and wrapped. On the window bench the washed and dried syringes are assembled, the plungers being lubricated with silicone; needles are sharpened and fitted to the syringes, which are then placed in "venesta" aluminium containers and capped with "ideal" aluminium-foil caps, using a manifold capping machine to take containers of different sizes; caps of different colours are used to distinguish syringe capacity and needle gauge. The advantage of this type of cap is that it adheres to the container and cannot be replaced as issued: a replaced cap therefore indicates a used syringe, whether it has been used or not, and is regarded as unsterile.

3. Autoclave Room

Assembled packs and miscellaneous items for wards and theatres are filled into special stainless-steel baskets on low trolleys and transported to the autoclave room. This room has two steam-pressure sterilizers and two hot-air ovens, the former for sterilization of packs and the latter for sterilization of syringes. All four sterilizers are built flush with the wall and may be serviced from the rear through a door. Both steam sterilizers are high-vacuum, operating at 28–29.5 in. (71–75 cm.) Hg, and a sterilizing temperature of 273° F. (134° C.). They are fully automatic and can be altered if desired, to operate at a sterilizing temperature of 250° F. (121° C.). We use a temperature of 273° F. for five minutes both for packs and for gloves, with completely satisfactory results.

The cycle of changes during the sterilizing procedure is visible on temperature and pressure gauges and a coloured lighting system, and is recorded on a time-temperature chart. One sterilizer has a capacity of 60 cu. ft. (1.7 cu. m.) and an overall cycle of 20 minutes, and the other a capacity of 50 cu. ft. (1.4 cu. m.) and a cycle of 35 minutes. The longer cycle is due to a less powerful vacuum pump, which is being replaced by a more powerful one, reducing the time and producing a

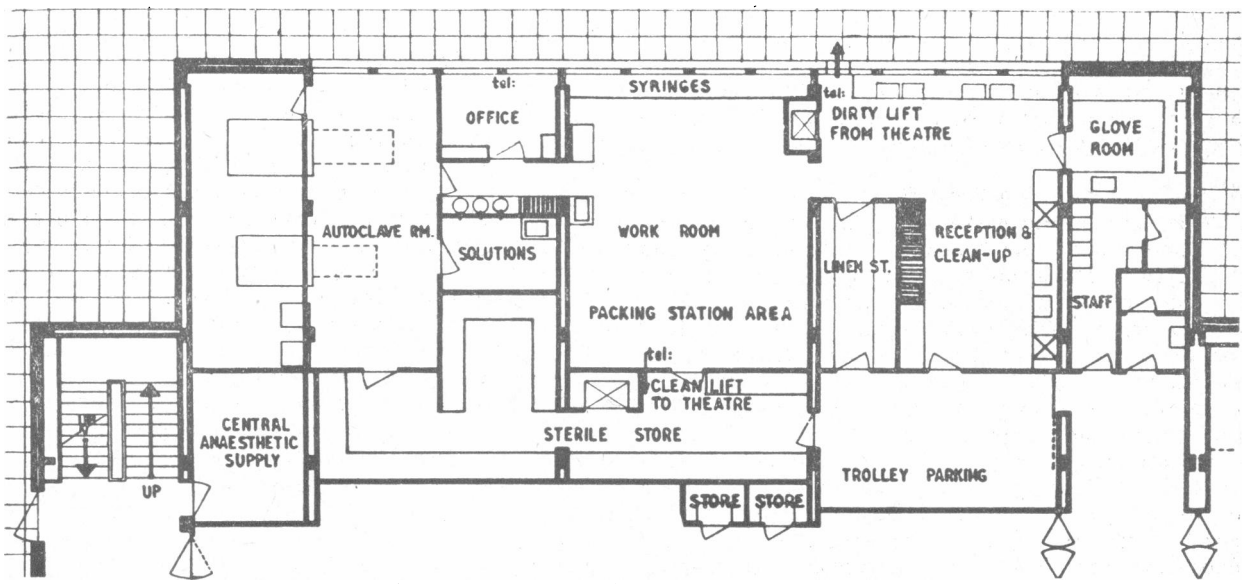

FIG. 1.—Plan of C.S.S.D., Nuffield House, Musgrave Park Hospital.

higher vacuum. The filled baskets are loaded into the sterilizers by two male orderlies. At the end of the cycle the chart is inspected by the sister-in-charge in order to check that the correct cycle has been followed. The sterilizer is then opened and the baskets are unloaded by the male orderlies, wearing asbestos gloves, and taken to the sterile store to cool. When cool the packs are placed in their designated positions on the shelves.

The hot-air ovens for sterilizing syringes are electric, are provided with fans and time–temperature recording charts, and are fully automatic. Each oven has a total capacity of 160 2-ml. syringes in four trays, with a smaller capacity if syringes of larger volume are being sterilized. The first cycle in the morning takes three hours, including maintenance of a temperature of 160° C. for one hour; succeeding cycles on the same day take two hours. The syringes in their sealed containers are issued in stout covered cardboard boxes (Fig. 2),

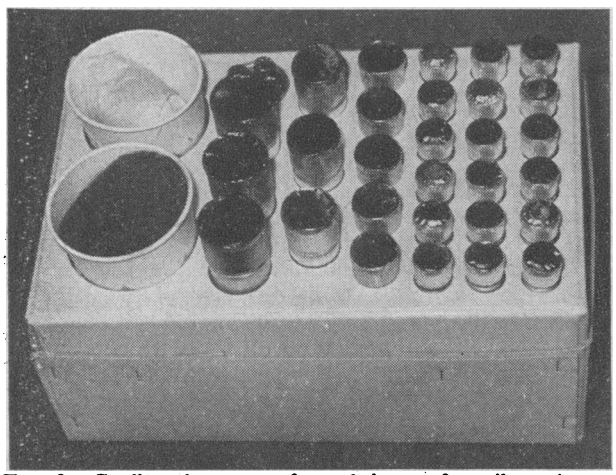

FIG. 2.—Cardboard carton of ward issue of sterile syringes. Contents: 18 2-ml. syringes; 5 5-ml. syringes; 3 10-ml. syringes; 3 20-ml. syringes; spare needles; monocup with foam-rubber sponge for used needles; monocup with swabs for skin preparation.

slotted to hold an adequate supply of syringes of different capacities for one day's use in each ward or theatre. Each box has also two unwaxed monocups, one containing a foam-rubber sponge to receive used needles and the other holding pledgets of cotton-wool used for skin preparation. The cardboard boxes have not stood up well to wear and have proved difficult to clean; however, a new box of similar design with a washable plasticized surface appears to overcome these difficulties.

4. Sterile Store

Here the sterilized packs and syringes are held ready for issue, stored on "dexion" shelving which can be adjusted as required. The different packs and miscellaneous items for wards and theatres all have their designated positions on the shelves. As a result of experience, no packs, with the exception of a few miscellaneous items infrequently asked for, remain on the shelves longer than 48 hours, as the preparation of the various packs is based on the rate of turnover. Packs are issued from the store to wards or theatres via a Dutch door against a written requisition, loaded on to trolleys, and protected during transport with a plastic cover. Emergency packs for the theatres on the floor above the C.S.S.D. are placed in a "clean" lift in the evening. At 8 a.m. packs for the morning's operations are placed in the lift against a written requisition. Arrangements have been made for emergency supplies during the night and off-duty hours.

Ancillary Rooms

There are also five ancillary rooms or areas.

(*a*) At the entrance to the C.S.S.D. is a *trolley bay* where trolleys are loaded, unloaded, or parked—the door for receiving and issue open directly into this bay.

(*b*) *Glove-processing room.*—This room was originally designed for needle-cleaning and sharpening and the maintenance of theatre instruments, gloves being processed in the receiving-room. It was found, however, that during the powdering of gloves, even by mechanical means, powder became dispersed into the air, and even into the barrels and on to the pistons of the syringes, causing them to stick. The processing of gloves was therefore transferred to this room, which is provided with a bench, a "bendix" washing-machine with water supply and waste for washing gloves, up to 40 pairs at a time, a thermostatically controlled automatic glove conditioner for drying gloves, 20 at a time for 15 minutes, and an automatic glove-powdering machine which powders a similar number of gloves in five minutes. The gloves are also examined and tested for tears or perforations, and patched or discarded—patched gloves are not supplied to the theatres. The gloves are then paired up and packed in cotton balloon cloth for sterilization. An extract fan is to be installed to remove dispersed powder.

(*c*) *Linen Store.*—This room is adjacent to the preparation room, and all linen (wraps, towels, gowns, etc.) required for packs is stored on "dexion" shelving; a bench in the store is used for folding linen, which is replenished as required from the hospital store.

(*d*) *Office.*—This is used by the sister-in-charge and is situated between the preparation and autoclave rooms. She is in telephonic communication with all parts of the hospital, and there is another telephone in the sterile store. Opposite the office is a large cupboard which contains three electric "manesty" stills for the supply of distilled water.

(*e*) *Solution Room.*—This is a small room off the autoclave room, provided with a bench, shelves, and cupboards, and was intended for the preparation of non-intravenous solutions for sterilization. It will not, however, be used for this purpose, because it was considered that the conditions for sterilizing fluids in steam-pressure sterilizers differ so much from those required for packs. These differences are the temperatures and time taken to sterilize fluids in relation to sizes and contents of containers, and the different cycle in relation to vacuum. This would necessitate periodic alteration of the automatic system and the temperature of sterilization, and would cause unjustified hold-up and waste of time, apart from the possibility of serious errors in the sterilizing techniques, bursting of bottles, and possible corrosion of the interior lining of the chamber, unless a non-corrosive lining was fitted Sterilization of fluids prepared in the hospital will be carried out by the pharmacist in a separate steam sterilizer in the pharmacy.

Ventilation in the department is natural, except in the sterile store, which has a plenum input system. The floors of the receiving-room and the autoclave room have tessellated tiles; elsewhere linoleum tiles have been used.

Changing, washing, and toilet accommodation, adjacent to the unit, is also provided for the C.S.S.D. staff.

This unit is a prototype, and certain modifications have been made in the light of experience, and more are being made. Racks and shelves are therefore demountable, and benches, drawers, and cupboards can be altered.

Staff and Teaching

The present establishment consists of a sister-in-charge, a staff nurse, an assistant nurse, six female orderlies, and two male orderlies—a total of 11. This is adequate, and compares favourably with the establishment of 24 employed in the C.S.S.D. for a 600-bed hospital in Canada. Nurses in the preliminary training school are taught the traditional methods of sterilization and ward procedure and the new method of packs. Two student nurses at a time spend a fortnight of their training in the department working as observers but are not counted on the working strength. They are taught the contents of the packs, how to set them out, and their use, and take part in all procedures in the department. Bound volumes containing photographs of the layout of all packs, with details of their contents, are provided for teaching and demonstration.

Provision of Sterile Packs

This service provides, in a sterile condition, a convenient and appropriate assortment of instruments and dressings in packs of each of the standard operations or procedures in the theatres and wards. Over a period of about four years the technical subcommittee has developed a series of standardized packs —a considerable undertaking when one considers the various items required for different operations, ward procedures, and the special demands of different surgeons and anaesthetists. All drums, Cheatle forceps, and all of 22 boiling-water sterilizers in use in the hospital have been discarded—representing a considerable saving on maintenance and replacement, as well as being a contribution to the prevention of infection.

Theatre Packs

Theatre packs are divided into five categories: general, orthopaedic, gynaecological, gynaecological (minor), and thoracic.

There are three basic packs for each category, designated major, intermediate, and minor. There are, in addition, supplementary packs, usually containing only a few items, which are added to a basic pack in order to give the correct assortment for any procedure, or to meet the requirements of a particular surgeon or anaesthetist. For the theatres 40 basic and supplementary packs are available. Theatre packs contain gowns, towels, gloves, masks, paper hand-towels; special packs include items such as basins, kidney bowls, gallipots, and dressings. The packs are wrapped in an inner layer of green balloon cloth and an outer layer of double balloon cloth. They are packed in such a way that they can be opened by the instrument nurse if necessary before she scrubs-up or by her assistant. The packs are secured by grass-tape, and a strip of adhesive pressure-sensitive tape on which are written the date and an identification code of the contents. All theatre packs are assembled and supervised by the staff nurse or sister-in-charge. Tests for sterility are carried out regularly by the insertion of Browne's tubes and *Bacillus stearothermophilus* spores into the centre of packs. Mackintosh sheets or jaconet are no longer used, because over 200 bacteriological tests showed that spores placed in the folds survived the sterilization cycle in 45% of the tests. Huckaback towelling has replaced mackintosh and jaconet.

Ward Packs

Ward packs are sterilized and divided into three categories: those for (1) "sterile" and (2) "clean" procedures, and (3) miscellaneous. Packs for "sterile" procedures have a double covering of white balloon cloth; those for "clean" procedures are wrapped in white crêpe paper—this requires some explanation. The use of balloon cloth for wrapping packs raised a problem of laundry costs, which were high. To overcome this it was decided to try paper. Numerous tests were carried out using different types of paper as wraps; kraft paper and some other papers burst or tore too easily after sterilization. A crêpe paper now in use is very satisfactory, but it does not drape readily for use on trolleys. However, a new embossed paper has recently been received, and on preliminary trials appears to be the answer.

Many dozens of tests have been carried out to estimate how long packs wrapped in a double layer of crêpe paper would remain sterile under different conditions. The method of Howie and Timbury (1956) was used, a gauze swab being placed immediately under the outer paper wrap on all six sides of the pack, together with a gauze swab, Browne's tubes, and *B. stearothermophilus* spores in the centre of the pack. Packs were prepared, sterilized, and placed on the store shelves for periods from one to eight weeks before being sent at the rate of one pack per week to the laboratory for test. Similar packs were also stored for one week, then sent to each of four wards, where they were kept till required for use, but instead of being used they were returned to the C.S.S.D. unopened for transmission to the laboratory. The results showed that packs kept in the sterile store would remain sterile for at least four weeks, and probably longer. The three packs, from each of which one unsterile swab was obtained after storage for five, seven, and eight weeks, yielded organisms—*Staphylococcus albus* and an aerobic sporing bacillus—which were present in the air of the laboratory in which the tests were carried out. This test was repeated and all packs remained sterile on aerobic culture up to eight weeks, the length of the experiment. All the packs stored, sent to the wards, and returned unopened were sterile. In every instance Browne's tubes were green and the *B. stearothermophilus* spores were killed.

A control set of four packs was wrapped in two layers of gauze, sterilized, and placed in the sterile store for one to four weeks, one pack being tested for sterility each week. All six swabs under the wrap of each of the four packs were unsterile, the contaminating organisms being predominantly *Staph. albus* coagulase-negative, with an aerobic sporing bacillus in a few instances, and a fungus on one swab. In each pack the swab in the centre was sterile, Browne's tubes were green, and *B. stearothermophilus* spores were killed. These results satisfied us that paper was a suitable medium for wrapping packs, from the point of view of maintenance of sterility.

Ward packs include complete dressings, separate small dressings, catheters, and sets for drainage,

irrigation, aspiration, intravenous cut-down (Fig. 3), as well as instruments, bowls, gallipots, and mouth trays. Over 70 different packs are supplied to the wards, including 22 for "sterile" procedures, 21 for "clean" procedures, and more than 30 miscellaneous items such as catheters, tubes, scissors, forceps, clips, gauze, and gamgee.

Examination of Services

The work of the unit has been kept under continuous review since it opened two years ago, and a work-study investigation has been carried out during the last six months, to assess the extent to which the service meets the demand of the hospital, to see what improvements could be made or introduced in trial form, and to study the cost of the service. Records (Fig. 4) have been kept of all issues of packs and syringes since the inception of the service.

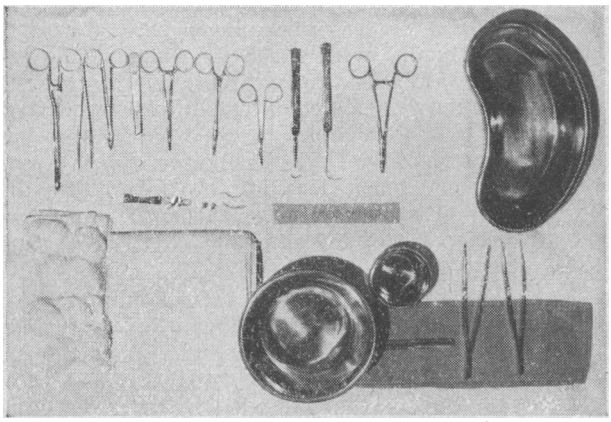

FIG. 3.—Intravenous cut-down pack ready for use.

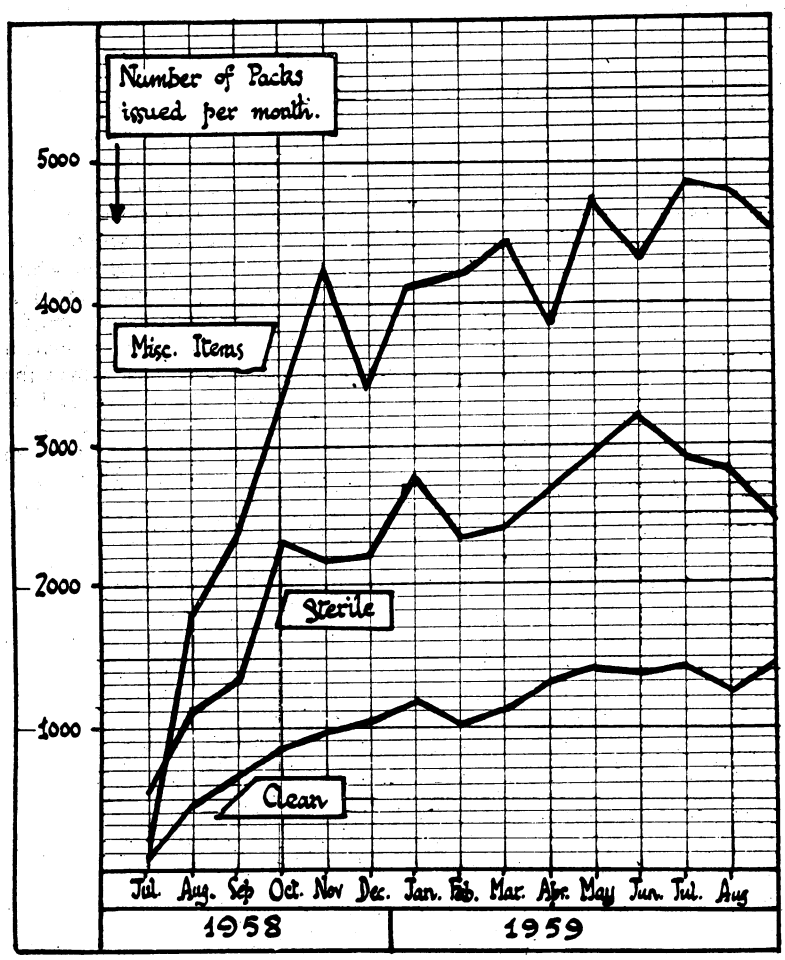

FIG. 4.—Monthly issues of ward packs.

Packs

Modifications to methods have been recommended and many have already been introduced, while others are planned. The main modifications are:

1. Because of early losses, scissors are issued as a separate pack and signed for by the ward orderly.

2. Drawers and cupboards contained an assortment of different items, which caused extra work in sorting and identification; because of this and the narrowness of benches when making up large packs, a new prototype packing station was assembled and put into use. The use of this new packing station has resulted in a considerable reduction in work content. It is therefore proposed to remove the existing benches, drawers, and wall cupboards used for making packs, and install three new packing stations (Fig. 5), two for ward packs and one for theatre packs, when an even greater reduction in work content is expected.* There will also be a bench for linen-folding and a stillage for autoclave baskets. The main principle involved in this replanning is that all supplies should be within arm's length.

3. Improved planning of trolley arrivals from wards to avoid overcrowding has been put into operation.

4. Returned articles from packs are now checked and collected at ward level instead of at the C.S.S.D.

5. The ward requisition list has been replanned to simplify data on issues and returns.

6. Improvements are planned for the methods of loading and unloading one of the two sterilizers.

The average labour cost per bed/day for ward packs has been estimated at 1.48d., and the average labour cost of theatre packs at 54d. per operation. Laundry costs are extra—about 15s. for packs for a major operation. Both of the labour costs are expected to be reduced when modifications have been made.

Syringes

The syringes used are glass with metal nozzle, interchangeable, with capacities of 2, 5, 10, and 20 ml. (tuberculin and insulin syringes are available if required). The present syringe usage is about 400 per day, of which 80% are of 2-ml. capacity, the remainder being fairly evenly divided. The total number of syringes originally supplied was based on three times the daily issue divided among the estimated capacities required plus 25% to cover emergencies and week-ends, when work ceased in the unit—this estimate has proved correct. After discussions with medical and nursing staff it was agreed that the sizes of needles supplied should be reduced from 14 to 5. The average life of a syringe supplied from the C.S.S.D. has been estimated at 135 usages; replacements average 15.5 per week, and breakages are less than 1% of the stock per week. Needles show an average of 36.6 usages before being discarded; replacements average 51.5 per week, and

*These alterations have now been made and an improved free-standing double packing station for ward packs has been installed.

only 12.5% of used needles are returned blunted. The hospital pharmacist, who supplies needles to the C.S.S.D., has stated that the present system uses fewer new needles per week for the whole hospital than was formerly used by one ward in a week. Syringe breakages appear to be nearly always where the metal butt is joined to the glass nozzle.

Recommendations for modification of methods include (1) improved apparatus for testing for needle blockage, (2) inquiry into the possibility of an automatic sharpening process, and (3) foot or power operation of the capping machine. The labour and replacement cost per syringe issued has been estimated at 3.29d., and implementation of certain of the recommendations is expected to reduce the cost to 2.95d. The addition of maintenance and services costs is estimated to bring the total cost per syringe up to about 4d. Disposable syringes and needles are at present on trial in this country at an estimated cost of approximately 5d. per syringe and 2d. per needle—a total of 7d. for 2-ml. syringes, rising to 14d. for 5-ml. and 18d. for 10-ml. syringes. Although the principle of a disposable syringe is an attractive one, comparison of current relative costs suggests that it is more expensive than the present system. Moreover, the hot-air ovens are far from working to full capacity, and consideration is to be given to extension of the syringe service to another large hospital, which should further reduce costs.

Gloves

Glove issues per week are of the order of 300 pairs, and on an average each glove is issued five times—evidence that the sterilization cycle with a temperature of 273° F. (134° C.) has no deleterious effect. A series of tests to check glove life, in which the gloves were sterilized, worn, removed, washed, dried, powdered, tested, turned, and repacked, showed that the gloves regularly burst at the sixth cycle. This suggests that gloves should perhaps not be reissued for theatre use more than four times, to allow for an adequate margin of safety. The total cost of labour and replacement of gloves per pair issued has been estimated at 10.4d., exclusive of laundry costs for the pack cover.

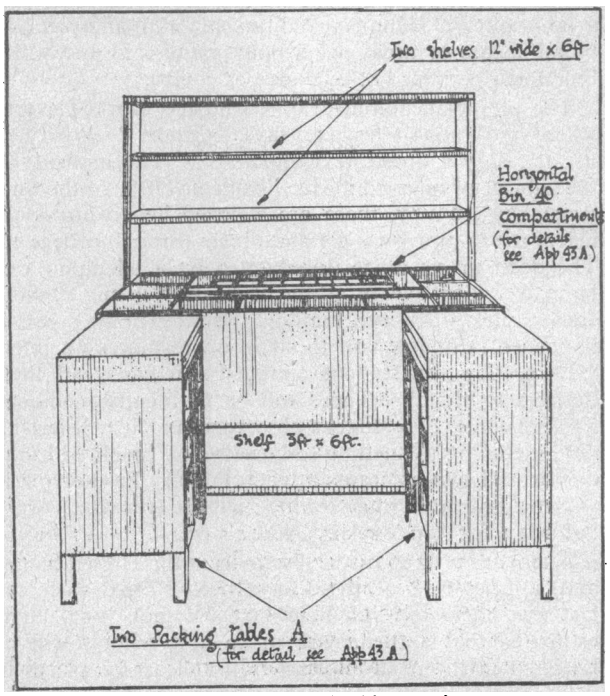

FIG. 5.—Prototype packing station.

Linen

The C.S.S.D. must ensure that the linen is sound, and free from tears or holes, and carry out correct folding. This is work which might be done by a trained worker in the hospital laundry; but at this hospital most of the laundry is at present sent to a commercial establishment. These difficulties will largely be overcome by the provision of a linen-folding table in the work room.

Equipment

The results of the work-study investigation indicate that (1) although eight sinks are installed, four would be adequate for current needs; (2) three benches, instead of the six installed, would suffice; (3) whereas eight packing stations are available, three would be adequate—two for ward packs and one for theatre packs; (4) the washing machine for gloves could cope with double the present demand; and (5) the glove-drying and glove-powdering machines could deal with four times the present turnover.

The total capacity of the steam sterilizers has for some time been recognized to be too great, and it has been estimated that one-half the present capacity would be adequate. It has, however, to be remembered, in extenuation, that this was a pioneer project in this country, that automatic, high-vacuum, high-temperature steam-pressure sterilizers had not hitherto been used, and that one of the sterilizers was a prototype. The greatly shortened sterilization cycle was also a circumstance which contributed to a larger turnover of sterilized packs, and at the time the numbers and sizes of packs were an unknown factor. Teething troubles have been experienced with both sterilizers, but these are gradually being overcome.

The electric hot-air ovens at present sterilize about 400 syringes per day, but if used to full capacity it is estimated that they could deal with 1,200. On the other hand, allowances must be made in the case both of the steam sterilizers and of the hot-air ovens for time spent in maintenance and curing breakdowns, which do occur, so the margin of excess needs must not be too narrow.

Increasing use is being made of disposable items, such as paper towels, paper for covering certain packs, aluminium-foil utensils, and catheters. All instruments, Cheatle forceps, and sterilizers have been removed from wards and departments, and no drums are used. Cardboard containers were considered as an alternative to fabric for packs, but for various reasons the consensus of opinion did not favour them. Such containers may have a place where packs are to be transported to hospitals in a group, although even here paper or "polythene" bags sealed with adhesive tape may be used as an additional protection against contamination. These are at present used for some packs which are in infrequent demand and for packs sent to the laboratory for sterility tests.

Conclusions

A C.S.S.D. may be one of two types: (1) that serving only the hospital in which it is situated, and (2) that serving a number of hospitals in a group within a radius of a few miles. The latter involves cost of transport, additional labour, and specially designed containers for distribution of packs within the hospitals. On the other hand, the C.S.S.D. serving its own hospital alone involves

accommodation, equipment, and staff at each hospital, and the comparative economics and personal service of the two schemes have not yet been assessed.

The scheme under consideration services only its own hospital, and there is no doubt that it is fulfilling the original principles for which it was designed. In the early stages there was a certain amount of doubt among both the nursing and the medical staff about its value and increased efficiency, but this has now been proved, and the staff would not consider reverting to former procedures. The time taken to do ward dressings has been reduced by nearly 50%, and the time taken to prepare trolleys between operations has been reduced from 10 to 5 minutes. The surgeons and theatre staff have co-operated fully and are well satisfied with the service provided. Infection records to date indicate a reduction in secondary infection of surgical wounds, but a two-year study at present under way will be necessary before definite conclusions can be arrived at. So far the total sepsis rate has been estimated at 3%.

In the work-study investigation of the department and its functions the salient points noted were: oversupply of equipment, excess demand for packs and gloves (to be controlled by keeping regular records of issues and returns), and the need for improvement of methods in the department by reorganization of storage facilities, packing surfaces, and sterilizer loading. The department is dynamic, and new materials and methods have been on trial since the department opened.

As regards staffing and control of the department, the appointment of a qualified and experienced member of the nursing staff as the officer-in-charge has proved an unqualified success. Only a trained nurse can discuss at a technical level with ward and theatre sisters and surgeons the problems which constantly demand attention; administrative ability and considerable tact are very necessary. Regular inspection and maintenance of equipment, especially sterilizers, should be carried out by the hospital engineer at not less than fortnightly intervals, as a preventive rather than a curative measure. Failure of sterilizers or hot-air ovens could seriously upset the work of the hospital, and for this reason there should be at least two steam-pressure sterilizers and two hot-air ovens. The consultant bacteriologist should play an important part in the maintenance and control of sterility and act in an advisory capacity, and also be conversant with the working of the sterilizers.

Thanks are due to the many people who have co-operated in the setting up of this department, especially the Nuffield Foundation and the Northern Ireland Hospitals Authority. Dr. Darmady has given helpful advice on syringe processing, and the Bowater-Scott Corporation Ltd. has kindly supplied many types of paper for trial. I am also indebted to the sister in charge of the department for much detailed information and co-operation in numerous laboratory tests.

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NEW AMERICAN MEDICAL SCHOOLS

BY

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To visit one of the new American university medical centres is to enter a world which is certainly not English. The language is spoken there, it is true, but much else is vastly different. It is not merely the scale of things, the display of wealth, the bold designs in shimmering glass and aluminium, nor the light and colour of the airy lounges with their murals and bright furnishings. Other things impress more. The entrance to the staff car park is by a gate which the driver opens by leaning out of his car and slipping a card into a slot in a post. In Los Angeles a medical student may drive in 40 miles at 6 a.m. to get a parking-place. Later that day you may see him in the psychiatry department watching an interview through "one-way" glass, listening to patient and doctor through earphones. Or you may meet him in the physiology laboratory performing a classical experiment with the aid of television.

In the wards you may see a patient selecting his meals from a printed and dated menu card or adjusting his electrically operated "high-low" bed or conversing on the bedside "intercomm" with a nurse at her station down the corridor. Like a captain on his bridge, she, with her aides, is in touch with all decks. She has her control panel with its switches and buttons, paging and signal systems, telephones, automatic conveyer, and pneumatic tubes, and, to port or starboard, her "floor manager" or "ward clerk." In the nursery, television helps the staff to keep a watch on a clutch of babies. In the ambulant wing a two-bed hotel-type room contains man and wife; only one is a patient. In a four-room apartment at the end of a ward floor the family of a disabled patient are taught "home-care." In a laboratory a technician adjusts his auto-analyser (40 blood sugars or ureas in an hour) or his red and white blood cell counter (12 seconds per count).

The physician administrator, who has worked everywhere and knows everyone, says, "Cancer? We'll lick it. It's only a question of dollars!" The matron, on the subject of married medical students (70% of the final year), says, "Why, there are a dozen here who would marry me to-morrow—if I'd put them through college!" The dean in his office (interrupted by a telephone call from a student's wife asking if he would mind telling Joe to pick up a rye loaf on the way home; yes, it happened!) invites you to sit in on to-morrow's interview session for student entry, "You can read their dossiers to-night." (There will be 12 faculty members, 24 applicants, two student observers, and it will last all day, including a "getting-to-know-you" lunch with one doctor and two aspirants at each table.) To-morrow is a Saturday, and interviewing will be repeated every Saturday for ten weeks. And so on.

There are now 85 medical schools in the United States, and, although 12 of these have been started since the last war, there are still nine States without one. It is estimated that a further 15 or so new schools will be required in the next 15 years. In at least 22 places in the country new schools are under consideration